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From Presale Financing to Project FinanceDeveloper Incentives, Credit Access, and Bank Risk in Housing Development

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From Presale Financing to Project Finance

Developer Incentives, Credit Access, and Bank Risk in Housing Development

Abstract

Housing presales provide construction-period funding but also expose buyers and lenders to noncompletion risk. This paper develops a project-finance model in which restrictions on early buyer funding increase the development loan required before completion, while bank pricing and a developer's unobservable completion effort are jointly determined. China's August 2026 housing reforms motivate the institutional setting, but the model addresses the more general financing trade-off created when advance customer funding is replaced by monitored project debt. Three results follow. First, stronger supervision and better recovery do not necessarily raise equilibrium completion probability: a larger debt burden can reduce the developer's retained payoff and weaken effort enough to offset the direct monitoring gain. Second, financing access depends on the joint consistency of loan pricing, effort, participation, and underwriting; under sufficient conditions this generates a project-equity threshold. Third, expected credit loss separates into risk-quality, exposure, and selection effects, so a safer continuing project can coexist with greater loan exposure or a changing set of financed projects. Numerical illustrations show the effort-feedback reversal and the equity-access boundary. The framework clarifies why financing access and bank risk should be evaluated separately when presale funding is restricted.

Keywords: Housing presales; Project finance; Developer incentives; Credit access; Bank credit risk; Housing regulation

JEL classification: G21; G28; L11; R31

1 Introduction

Housing development requires substantial expenditure before a completed dwelling can be delivered. Presales bridge this timing gap by bringing buyer funds forward, but they also shift part of construction-period risk to buyers and make the control of advance payments consequential for lenders. When regulation delays the point at which buyer funds can be used for construction, the missing cash must be replaced by developer equity, bank credit, or other finance. The central question is therefore not simply whether stricter presale rules make projects safer, but whether the replacement financing changes developer incentives, credit access, and bank losses in ways that offset the direct gain in delivery security.

China's housing sales and financing measures announced on 28 August 2026 provide a concrete institutional motivation. They tighten the timing and use of presale proceeds, strengthen project-account controls, assign a lead bank to development lending, and postpone mortgage disbursement on presold new housing until completion filing. The analysis uses these measures to motivate a local policy path along which legally usable buyer funding before completion declines while direct supervision and lender recovery may improve. The model does not estimate the realized effects of the reforms and does not treat the policy index as an empirical score.

Existing research establishes the main building blocks separately. Presales can relax financing constraints and affect production and sales timing (Chan et al., 2008; Li & Chau, 2019; Li et al., 2023), allocate price and completion risk between developers and buyers (Lai et al., 2004; Chan et al., 2012; Edelstein et al., 2012), and interact with leverage and lender pricing (Chan et al., 2014). Project-finance and banking research shows how dedicated cash-flow control, monitoring, borrower resources, and lender capital affect financing contracts (Diamond, 1984; Holmström & Tirole, 1997; Esty, 2004; Subramanian & Tung, 2016). The closest institutional study is Chen et al. (2024, revised 2026), which separates presale eligibility from supervision of presale funds and studies liquidity and strategic abandonment. The present paper instead focuses on how replacing early buyer funding with development debt changes the financing contract itself when loan pricing and completion effort must be mutually consistent.

The mechanism is a pricing–incentive feedback. Later availability of presale proceeds raises the development loan required before completion. A larger promised debt payment reduces the developer's residual payoff in the success state, which can weaken unobservable completion effort. The induced success probability feeds back into the bank's break-even rate, and that rate in turn changes the developer's residual payoff. Direct improvements in monitoring and net recovery work in the opposite direction. Consequently, a reform can make project accounts more controlled while still reducing equilibrium completion probability or narrowing the set of financeable projects.

The paper makes three economic contributions. First, it identifies an endogenous incentive channel through which a reduction in early buyer funding can overturn the direct effect of stronger supervision: even when regulation raises the success probability holding effort fixed, equilibrium completion probability can fall because additional debt service weakens effort. Second, it distinguishes a quoted or algebraically admissible loan rate from a feasible development-finance contract. A project is financed only when the pricing–effort fixed point also satisfies probability bounds, positive effort, developer participation, and bank underwriting; under stated sufficient conditions these restrictions generate a single project-equity threshold. Third, it decomposes bank credit risk into risk-quality, exposure, and selection effects. Better completion and recovery can lower loss conditional on a fixed principal, while the replacement of presale cash increases the principal at risk and changes which projects remain financed. These results explain why loan rates, credit access, and portfolio losses need not move in the same direction.

The analysis deliberately keeps demand, project size, and the distribution of project equity fixed in order to isolate this financing mechanism. Section 2 relates the institutional motivation to the literature on presales, project finance, monitoring, and credit access. Section 3 specifies project cash flows, bank pricing, and developer effort. Section 4 closes the pricing–effort feedback and characterizes the feasible financing set. Section 5 derives comparative statics and numerical illustrations. Section 6 combines financing access and credit-loss responses into conditional scenarios and empirical implications. Section 7 discusses economic implications and limitations, and Section 8 concludes. Appendix A provides complete derivations and logical checks, and Appendix B defines notation.

2 Institutional motivation and related literature

The policy motivation and the literature point to the same economic distinction: a signed sale, cash received into a regulated account, and cash legally available to fund construction are not equivalent. This section first isolates the funding change represented in the model and then locates the pricing–effort mechanism relative to research on presales, project finance, and credit access.

2.1 Institutional motivation: the construction-period funding gap

The August 2026 housing sales measures raise the construction milestone for presales and give priority to completed-housing sales for specified new projects, while buyer payments remain subject to regulated accounts (Ministry of Housing and Urban-Rural Development et al., 2026). Economically, these rules can delay the amount of buyer cash that is usable for construction even when a sale agreement has been signed. The model therefore tracks legally usable early funding rather than contracted sales or gross balances in a presale account.

The development-lending measures require a lead bank for each project, separate project accounts, and prior injection of project equity; development loans cannot finance specified land premiums and related taxes (National Financial Regulatory Administration, 2026). These provisions motivate the project-finance features of the model: project cash flows are separately identified, monitoring has a cost, and lender recovery may improve. They do not imply that every real-world loan is nonrecourse, so limited-recourse repayment is imposed only in the benchmark contract used below.

The credit-management opinions postpone mortgage disbursement on presold new housing until completion filing and distinguish new contracts from earlier arrangements (People's Bank of China & National Financial Regulatory Administration, 2026). Capital-market measures also support eligible equity, debt, securitization, and real-estate investment vehicles (China Securities Regulatory Commission, 2026). Because those instruments differ in timing and permitted use, the model does not treat them as interchangeable sources of construction finance.

The common implication is a possible substitution away from early buyer funding toward developer equity and monitored external finance during construction. The model represents that substitution by a scalar policy path. This device keeps the comparative statics tractable and leaves the joint movement of reform components across projects and cities outside the analysis.

This funding interpretation connects the institutional setting to three strands of research: the financing and timing role of presales, the allocation of completion risk and developer incentives, and the organization and pricing of project credit.

2.2 Presales, development timing, and risk allocation

Real-estate development is an irreversible investment whose timing has option value under uncertainty (Titman, 1985; Bulan et al., 2009). Presales alter that timing problem by bringing receipts forward. Chang and Ward (1993) document the financing role of forward sales, while Chan et al. (2008) formally connect presales to financing constraints and developers' production decisions. Li and Chau (2019) show that presale motives differ with developers' financing conditions, and Li et al. (2023) link regulatory access to presales with the chosen timing of sales. These results imply that delaying usable buyer receipts can increase the amount of funding that must be raised elsewhere before completion.

The financing benefit of presales is accompanied by risk allocation. Lai et al. (2004), Chan et al. (2012), and Edelstein et al. (2012) show how forward sales distribute price, default, and abandonment risks between developers and buyers. Ong (1999) emphasizes adverse selection when developer quality is imperfectly observed, whereas Gwin and Ong (2000) model hidden builder effort. Observed forward-sale prices also reflect dimensions other than noncompletion risk: developer reputation and anticipated quality can be capitalized in forward prices (Chau et al., 2007), purchase-to-occupancy delay can be associated with a presale discount (Hwang & Quigley, 2010), and restrictions on forward sales can affect spot-price volatility (Wong et al., 2006). Evidence from Beijing further shows that construction-quality awards can generate resale premiums without a comparable presale premium (He & Wu, 2016). These findings motivate distinguishing ex ante developer quality from the completion effort induced by a financing contract, while cautioning against treating every presale price gap as a direct measure of delivery risk.

Bank exposure adds a further layer. Deng and Liu (2009) connect developer delivery risk in presold housing to household mortgage outcomes, and Chan et al. (2014) show that presales and leverage can shift risk when lenders do not fully adjust pricing. The present model makes that pricing response endogenous to the completion probability generated by the contract, while keeping household mortgage termination outside the modeled loss measure.

2.3 Project finance, monitoring, and developer incentives

Replacing early buyer funding with debt changes the payoff retained by the developer after successful completion. Myers (1977) establishes that risky debt can distort real decisions, and Holmström and Tirole (1997) make borrower resources and intermediary capital central to financing under moral hazard. In the present setting, the relevant margin is continuous completion effort: a larger debt claim can reduce the developer's success-state residual and therefore the incentive to exert effort.

Project finance also changes who controls cash flows. Chemmanur and John (1996), Esty (2004), and Subramanian and Tung (2016) show how separate entities, limited recourse, contractual restrictions, and lender-controlled accounts can make project cash flows more verifiable while reducing financing flexibility. This motivates dedicated project accounts and an explicit net-recovery parameter, rather than an assumption that ring-fencing mechanically eliminates lender loss.

Monitoring determines how lenders use information and control. Diamond (1984) provides the delegated-monitoring foundation; Chen et al. (2000) connect monitoring to loan pricing; and Carletti (2004) studies the trade-off between concentrated monitoring and multiple-bank finance. Carletti et al. (2007) further show that diversification gains can offset free-riding and duplicated monitoring in multiple-bank lending. Evidence on syndicated lending likewise emphasizes the allocation of monitoring responsibility and exposure (Sufi, 2007; Gatti et al., 2013). The model

captures bank heterogeneity through funding costs, capital charges, monitoring efficiency, and markups, while taking monitoring intensity along the policy path as given.

2.4 Credit access and the closest related work

Credit access is a distinct margin from the quoted loan rate. Stiglitz and Weiss (1981) show how imperfect information can generate credit rationing, and Holmström and Tirole (1997) link financing capacity to borrower and intermediary resources. Real-estate evidence also shows heterogeneous replacement-finance capacity: Ambrose and Peek (2008) find that weaker local bank conditions shift U.S. homebuilder market shares toward firms with better capital-market access. A change in presale funding can therefore affect the composition of development even when the underlying housing projects are otherwise similar.

Gabrovski and Ortego-Marti (2025) model construction financing through search and matching, connecting financing frictions to entry, construction, and housing-market liquidity. Kiyotaki and Moore (1997) emphasize collateral feedback, while Hopenhayn (1992) provides a broader framework for selection among heterogeneous firms. The present analysis holds demand and the project-equity distribution fixed and instead asks whether a candidate project can satisfy jointly determined loan-pricing and effort conditions once a potential lender is available.

2.5 Presale regulation and the model's incremental contribution

Research on China's presale system emphasizes that eligibility rules, escrow, supervision, and institutional responsibilities are separate design dimensions (Leung & Ma, 2013). Huang et al. (2025) embed presales in a general-equilibrium environment in which demand shocks weaken developer balance sheets and diversion of receipts amplifies leverage and default risk. That broader macroeconomic channel is intentionally held fixed here so that the contract-level substitution between early buyer funds and development credit can be isolated.

The closest institutional analysis is Chen et al. (2024, revised 2026). It separates the construction milestone required before presales from supervision of funds after sale, links these instruments to liquidity and strategic abandonment, and reports evidence from earlier Chinese project cohorts. Its theoretical ambiguity arises because stronger presale criteria can improve incentives while reducing liquidity. The present paper takes the next step on the financing-contract margin: the development-loan rate responds to the completion probability induced by the contract, and that rate feeds back into the developer's retained payoff and effort.

This feedback produces results that are not implied by the separate literatures. A real solution to the pricing equation need not be a feasible contract; a feasible set can be summarized by an equity threshold only under additional conditions; and lower project risk need not imply lower expected bank loss when the required loan principal rises. The model therefore separates within-project risk quality from the extensive margin of which projects obtain finance.

Formally, a specified combination of sales timing, usable presale funds, monitoring, and recovery is represented by a scalar policy index. Early usable funding falls along this path, while direct supervision and net lender recovery may improve under stated assumptions. The coefficients remain explicit because the model does not claim that tighter regulation has a universally favorable or unfavorable effect.

The model evaluates new investment or reinvestment before capital is irreversibly committed. It does not prescribe liquidation of unfinished projects with sunk equity, solve for endogenous sales timing or financing search, model household purchase decisions, or derive aggregate house-price feedback. These limitations define the interpretation of the comparative statics that follow.

3 Project cash flows and contracting

3.1 Timing and financing requirements

There are three dates and one fixed-size project per developer. At date 0, the developer commits project equity and undertakes the project conditional on anticipated financing. At date 1, the bank offers a loan contract and the developer chooses unobservable effort. At date 2, the project either succeeds, receives the remaining sales proceeds, and repays debt, or fails and is resolved. All money amounts use a common unit. The opportunity cost of equity is normalized to zero, and the loan rate incorporates financing costs over the project horizon.

Let C denote total project expenditure and C_0 the component that cannot be paid with a development loan, including the relevant land expenditure and taxes. Project equity n_i is cash that can actually be invested in project i, with $n_i \geq C_0$. It is not the developer group's reported net assets. Other legal requirements, including applicable capital ratios, are included in the external eligibility domain.

Let $\theta \in [0,1]$ index the policy path and let $S(\theta)$ denote buyer funds legally available before the modeled construction financing gap must be met. The benchmark is

$$S(\theta) = S_0(1-\theta), L_i(\theta) = C - n_i - S(\theta), S_0 > 0. \tag{1}$$

Thus $S_\theta = -S_0$ and $L_{i\theta} = S_0$ for fixed C and n_i. Equation (1) combines an assumed linear funding schedule with a financing identity. The analysis requires $L_i > 0$. Self-financed projects lie outside the loan demand domain. The assumption $n_i \geq C_0$ implies $L_i \leq C - C_0 - S$, so the loan does not finance the excluded component of expenditure. Legal drawdown and payment schedules are compressed into one funding gap; aggregate funding sufficiency is assumed to imply construction liquidity sufficiency.Table 1 summarizes the timing convention used in the model.

Table 1 Project cash flows and institutional timing

Date	Project cash flows and decisions	Interpretation
0	Equity n_i is committed; separate capacity to meet compliance expenditure is required.	Capital is project-specific and the decision is evaluated before commitment.
1	$n_i + S + L_i = C$; a loan rate is agreed before effort is chosen.	S includes only usable construction funds, excluding undisbursed mortgages and restricted balances.
2	Success produces remaining receipts $V - S$; failure yields lender recovery ρL_i.	Early receipts are not counted again. Recovery is net of priority claims and resolution costs.

3.2 Technology and state contingent value

Developer i has baseline capability a_i. Effort increases the probability of successful completion:

$$q_i(\theta) = a_i + \gamma\theta, p_i(e_i, \theta) = q_i(\theta) + e_i, \gamma > 0. \tag{2}$$

We require $0 < q_i < 1$ and restrict effort to $0 \leq e_i \leq 1 - q_i$. The financing analysis concerns interior choices with $e_i > 0$ and $p_i < 1$. Effort has a nonpecuniary cost

$$\psi(e_i) = \frac{i_2^e}{2\eta}, \eta > 0. \tag{3}$$

A larger η means a lower marginal cost of effort at any given positive effort level. If payoffs are measured in money, η has the reciprocal money unit needed to make ψ and the monetary payoff comparable. The direct effect $\gamma > 0$ is an assumption about the specified path, not a theorem that equilibrium completion improves.

The total sales value in the success state and the bank's net principal recovery rate in failure are

$$V(\theta, d) = V_0 + d + h\theta, \rho(\theta) = \rho_0 + s\theta. \tag{4}$$

Here d is an exogenous demand condition, $h \geq 0$, $s > 0$, and $0 \leq \rho \leq 1$ throughout the comparison. The coefficient h represents a local reduction in a delivery-risk discount holding other pricing determinants fixed. It does not represent a general equilibrium house price response. Similarly, $s > 0$ assumes that the institutional change raises the bank's net recovery after buyer claims, creditor priorities, and resolution costs. It is not implied by ring-fencing alone. With early usable receipts already spent, success produces $V - S$ in remaining project receipts.

3.3 Bank costs and pricing

Bank j has a funding cost rate $r_{fj} \geq 0$, a capital charge $k_j \geq 0$, and monitoring efficiency $\mu_j > 0$. Monitoring cost is proportional to the loan:

$$M_j = \frac{m\theta L_i}{\mu_j}, c_j = r_{fj} + k_j + \frac{m\theta}{\mu_j}, A_j = 1 + c_j - \rho > 0. \tag{5}$$

The parameter $m \geq 0$ scales monitoring cost. Monitoring intensity is induced by the institutional path; the bank does not separately optimize an information production technology. The capital charge is a reduced-form cost, not an endogenous bank capital supply schedule.

If the success-state loan rate is r, expected bank profit is

$$\Pi_{Bij}(r) = [p_i(1 + r) + (1 - p_i)\rho - (1 + c_j)]L_i. \tag{6}$$

Success repays principal and interest; failure returns ρL_i. Equating (6) to zero and dividing by positive $p_i L_i$ gives the break-even rate

$$\bar{r}_{ij} = \frac{c_j + (1 - p_i)(1 - \rho)}{p_i} = \frac{A_j}{p_i} + \rho - 1. \tag{7}$$

The actual rate includes a specified nonnegative markup:

$$ij_*^r = \bar{r}_{ij} + \zeta_{ij}, \zeta_{ij} \geq 0, \Pi_{Bij}(ij_*^r) = p_i \zeta_{ij} L_i. \tag{8}$$

The markup can vary differentiably along the policy path, but its level is not obtained from a bank pricing game. The bank anticipates the developer's effort response to the offered contract. A financing fixed point therefore requires consistency between the probability entering (7) and the effort induced by (8).

3.4 Developer effort and participation

Consider the benchmark without additional shareholder guarantees or recourse beyond the project. The developer receives no residual in failure. Let $F\theta$ be compliance expenditure funded independently of the construction loan, with $F \geq 0$; it is neither part of C nor included again in n_i. The developer must have separate resources to meet it. The success-state residual and expected payoff before committing equity are

$$X_i = V - S - (1 + ij_*^r)L_i, \pi_i = p_i X_i - n_i - \frac{i_2^{e}}{2\eta} - F\theta. \tag{9}$$

At the effort stage the loan contract is fixed, so X_i does not change with e_i. Differentiation gives $\partial \pi_i / \partial e_i = X_i - e_i/\eta$ and $\partial^2 \pi_i / \partial i_2^{e} = -1/\eta < 0$. The unique interior optimum is

$$i_*^{e} = \eta X_i, p_i = q_i + \eta X_i. \tag{10}$$

The retained success payoff must be positive for an interior solution. Accordingly, the contract leaves enough cash to repay the loan in the success state. The full constrained best response is supplied in Appendix A to clarify why (10) is restricted to the interior.

At an interior optimum, substituting $e_i = p_i - q_i$ and $X_i = (p_i - q_i)/\eta$ into (9) yields

$$i_*^{\pi} = \frac{i_2^p - i_2^q}{2\eta} - n_i - F\theta. \tag{11}$$

Developer participation requires $i_*^{\pi} \geq 0$. Bank underwriting separately requires $p_i \geq \bar{p}_j$, where the cutoff $\bar{p}_j \in (0,1)$ is fixed in the local policy comparison. Neither condition follows from the existence of a real financing root.

For a continuing interior contract, a prime denotes the total derivative along the policy path, holding project equity and the demand state fixed. The effort first-order condition cancels the effort derivative in the payoff derivative, giving

$$(i_*^{\pi})' = \gamma X_i + p_i[h - ij_*^r S_0 - L_i(ij_*^r)'] - F. \tag{12}$$

The direct probability term is γX_i, not $i^p X_i$, after applying the envelope cancellation. Equation (12) retains the equilibrium change in the contract rate. Appendix A derives it directly from (9), including all terms that cancel.

4 Financing fixed points and the feasible set

4.1 Closing the pricing and effort feedback

Define the project payoff before the probability-dependent component of repayment and the corresponding linear coefficient:

$$H_{ij} = V - S - (\rho + \zeta_{ij})L_i, B_{ij} = q_i + \eta H_{ij}. \tag{13}$$

Equations (7)–(10) imply $X_i = H_{ij} - L_i A_j / p_i$ and $p_i = B_{ij} - \eta L_i A_j / p_i$. Multiplication by positive p_i gives

$$i_2^p - B_{ij} p_i + \eta L_i A_j = 0. \tag{14}$$

Completing the square gives the discriminant and the two candidate roots:

$$\Delta_{ij} = ij_2^B - 4\eta L_i A_j, ij_{\pm}^p = \frac{B_{ij} \pm \sqrt{\Delta_{ij}}}{2}. \tag{15}$$

The discriminant must be nonnegative for real roots. Real roots alone need not belong to the probability domain or induce participation. In particular, a root at or below q_i cannot be a positive effort solution, and a root at or above one is outside the maintained interior domain.

4.2 All feasible interior contracts

For the capital cross-section, fix capability a, demand d, and other primitives, and write $q = a + \gamma\theta$. Let N contain the project equity values that satisfy the external eligibility and independent compliance funding requirements. For each bank and each sign $\sigma \in \{+, -\}$, define

$$j_{\sigma}^e = j_{\sigma}^p - q, j_{\sigma}^r = \frac{A_j}{j_{\sigma}^p} + \rho + \zeta_j - 1, j_{\sigma}^{\pi} = \frac{(j_{\sigma}^p)^2 - q^2}{2\eta} - n - F\theta. \tag{16}$$

The algebraic domain is

$$D_j = \{n \in N : L > 0, A_j > 0, B_j > 0, \Delta_j \geq 0\}. \tag{17}$$

The sign-specific feasible set adds the economic restrictions:

$$j_{\sigma}^{\mathcal{F}} = \{n \in D_j : q < j_{\sigma}^p < 1, j_{\sigma}^{\pi} \geq 0, j_{\sigma}^p \geq \bar{p}_j\}. \tag{18}$$

The full set in the specified interior contract class is the union over roots and banks:

$$F_j = F_j^+ \cup F_j^-, \quad F = \bigcup_j F_j. \tag{19}$$

The use of "full" in this definition is relative to the stated contract class. It excludes corner effort, self-finance, alternative securities, guarantees outside the benchmark, and loan structures not represented by (8). The inequalities in (18) are necessary and sufficient within that class because they produce the unique interior effort optimum, a participating developer, an underwritten loan, and nonnegative expected bank profit.

If both distinct roots are feasible for the same bank, the higher root has a lower rate and a higher developer payoff. We assume both contracts can be offered and select the higher root in that case. If only the lower root is feasible, it remains in the set. A repeated root is counted once. The convention concerns contract availability and selection; dynamic stability and the equilibrium of a bank quotation game lie outside the model.

For M potential projects and a fixed equity distribution G, the number financed is

$$N(\theta) = M \int_{\mathrm{N}} \mathbf{1}\{n \in F(\theta)\}\, dG(n). \tag{20}$$

The bank union prevents multiple counting. With heterogeneous capability as well as equity, the same construction is integrated over their joint distribution. Equation (20) remains the appropriate expression when the feasible set has several intervals or when different restrictions determine different boundaries.

5 Comparative statics

5.1 Loan rates and contractual interest

Unless stated otherwise, derivatives refer to a selected feasible higher-root contract with $\Delta_{ij} > 0$, slack inequality constraints, and no bank or root switch. The funding and capital cost rates are fixed along the policy path. Suppressing indices gives

$$A' = m/\mu - s, B' = \gamma + \eta[h + S_0(1 - \rho - \zeta) - L(s + \zeta')]. \tag{21}$$

Implicit differentiation of (14), using that twice the selected higher root minus B equals the square root of the discriminant, gives

$$p' = \frac{B'p - \eta[S_0 A + L(m/\mu - s)]}{\sqrt{\Delta}}. \tag{22}$$

The probability derivative in the bank's pricing equation is this total derivative, which includes the effort response. Define the effect of changing risk quality on expected loan receipts at the break-even rate as

$$T = p'(1 + \bar{r} - \rho) + (1 - p)s, 1 + \bar{r} - \rho = A/p > 0. \tag{23}$$

Differentiating the bank break-even condition yields

$$\bar{r}' = \frac{m/\mu - T}{p}, (r^*)' = \frac{m/\mu - T}{p} + \zeta'. \tag{24}$$

Proposition 1. On a differentiable feasible interior branch, the break-even rate and actual contract rate decline under the following necessary and sufficient conditions:

$$\bar{r}' < 0 \Leftrightarrow T > m/\mu. \tag{25a}$$

$$(r^*)' < 0 \Leftrightarrow T > m/\mu + p\zeta'. \tag{25b}$$

For contractual interest $I = r^* L$, the corresponding condition is

$$I' < 0 \Leftrightarrow T > m/\mu + p\zeta' + \frac{pr^* S_0}{L}. \tag{26}$$

Proof. Since $p > 0$, the first two equivalences follow by rearranging (24). The product rule gives $I' = L(r^*)' + r^* S_0$; multiplying by $p/L > 0$ gives (26). Appendix A expands the bank derivative before this rearrangement.

The distinction is economically relevant. Risk improvements may lower the rate while the larger loan raises contractual interest. Moreover, T can be negative because effort may decline enough to make $p' < 0$. The quantity I is promised interest in the success state; it is not realized interest in all states or an accounting measure of lifetime expected bank income.

5.2 A sufficient condition for one project equity threshold

From (15),

$$\Delta_\theta = 2BB_\theta - 4\eta[S_0A + L(m/\mu - s)]. \tag{27}$$

Holding other primitives fixed while varying recovery gives $B_\rho = -\eta L$ and $A_\rho = -1$, so

$$\Delta_\rho = 2\eta L(2 - B). \tag{28}$$

Thus recovery reduces B, rather than increasing it. Its net effect on the discriminant is positive when both roots are positive and the higher root is below one, because the sum of the two roots is then below two. A change in recovery alone must not be confused with the entire policy path in (27).

Suppose only project equity varies and the markup does not depend on equity. Then $L_n = -1$ and $B_n = \eta(\rho + \zeta)$, which imply

$$\Delta_n = 2\eta B(\rho + \zeta) + 4\eta A > 0. \tag{29}$$

Monotonicity of the discriminant is insufficient to establish monotonicity of the full financing set. Participation or the upper probability bound can still bind. The following conditions address those additional restrictions.

Proposition 2. Consider one bank and a fixed equity support $[n_L, n_U]$. Suppose $L > 0, A > 0, B > 0, 0 < q < 1$, and $\rho + \zeta \geq 0$ throughout the support, and $\Delta(n_L) < 0 < \Delta(n_U)$. There is a unique $\bar{n}$ with $\Delta(\bar{n}) = 0$. Write $p_0 = B(\bar{n})/2$. If

$$p_0 > q,\ p_0 \geq \bar{p},\ p^+(n_U) < 1,\ \pi(\bar{n}) \geq 0, \tag{30}$$

and

$$p_0 A \geq \sqrt{\Delta(n_U)}, \tag{31}$$

then the full feasible interior financing set is $[\bar{n}, n_U]$.

Proof. Equation (29) excludes real roots below $\bar{n}$. Above it, implicit differentiation gives $p_n = \eta[(\rho + \zeta)p + A]/\sqrt{\Delta} > 0$. The endpoint conditions preserve the probability and underwriting restrictions. Differentiating (11) gives $\pi_n = p[(\rho + \zeta)p + A]/\sqrt{\Delta} - 1$. Its lower bound is $p_0 A/\sqrt{\Delta(n_U)} - 1 \geq 0$, so participation cannot fail again at higher equity. Continuity includes the boundary. Appendix A supplies the complete chain of inequalities and a numerical configuration satisfying every condition.

If these conditions continue to hold in a neighborhood of the policy value, the implicit function theorem and continuity of G give

$$\bar{n}' = -\frac{\Delta_\theta(\bar{n},\theta)}{\Delta_n(\bar{n},\theta)}, N = M[1 - G(\bar{n})]. \tag{32a}$$

$$N' = -Mg(\bar{n})\bar{n}', \tag{32b}$$

where g is the fixed density when it exists. A negative Δ_θ at the boundary raises the threshold and lowers access, strictly when $g(\bar{n}) > 0$. If participation, underwriting, an effort boundary, or external eligibility becomes binding instead, the discriminant boundary alone no longer determines access. Equation (20) must then be used with the appropriate boundaries.

These results describe new financing and reinvestment decisions. They do not establish immediate exit of existing developers, concentration in a national industry, or changes in ownership shares. Only with one equally sized project

per firm and a completely represented market does the illustrative concentration identity $HHI = 1/N$ follow. Its derivation is included in Appendix A.

5.3 Individual and portfolio expected credit loss

Let expected credit loss refer to expected unrecovered loan principal:

$$EL = (1-p)(1-\rho)L. \tag{33a}$$

$$EL' = (1-p)(1-\rho)S_0 - [p'(1-\rho) + (1-p)s]L. \tag{33b}$$

The measure covers one horizon in a theoretical setting; foregone interest, unexpected loss, and full financial-reporting impairment fall outside it.

Proposition 3. For a continuing feasible interior loan, expected credit loss falls if and only if

$$[p'(1-\rho) + (1-p)s]L > (1-p)(1-\rho)S_0. \tag{34}$$

Under Proposition 2 and the regularity conditions for differentiation of the integrals below, aggregate lending and portfolio expected loss also include a changing-access component.

The right side of (34) is the additional exposure created by lost early funding. The left side is the net improvement in risk quality at the existing loan size. It can be negative if the effort response is sufficiently adverse. This is why a positive direct supervision effect does not by itself imply lower expected credit loss.

In the one-bank threshold case, aggregate lending is

$$Q = M \int_{\bar{n}(\theta)}^{n_U} L\,(n,\theta)g(n)\,dn. \tag{35a}$$

$$Q^{'} = S_0 N - ML(\bar{n},\theta)g(\bar{n})\bar{n}^{'}. \tag{35b}$$

Portfolio expected credit loss is

$$\mathcal{E} = M \int_{\bar{n}(\theta)}^{n_U} E\,L(n,\theta)g(n)\,dn. \tag{36a}$$

$$\mathcal{E}' = M \int_{\bar{n}}^{n_U} E\,L_\theta(n,\theta)g(n)\,dn - MEL(\bar{n},\theta)g(\bar{n})\bar{n}'. \tag{36b}$$

The first terms in (35b) and (36b) concern projects that continue to be financed. The second terms concern projects at the access boundary. If the threshold falls, continuing loans and new access both raise total lending. If it rises, larger continuing loans and lost access act in opposite directions. Expected losses aggregate by linearity of expectation, without an independence assumption. Their sum does not measure loss correlation, tail risk, contagion, or bank capital adequacy.

Proof. Apply the product rule to (33a) and the moving-boundary differentiation rule to (35a) and (36a). Because the probability derivative can diverge at a repeated root, the loss derivative integral is interpreted as an improper integral. Appendix A gives the endpoint expansion and the conditions under which that singularity is integrable. Changing distributions, support endpoints, banks, or additional boundaries require additional terms.

5.4 Comparing bank contracts

Banks have no capacity constraints in this comparison. The developer chooses the lowest actual rate among banks whose selected contracts satisfy all feasibility conditions:

$$i_*^j \in arg\,min_{j:\, n_i \in \mathcal{F}_j(\theta;a_i)}\, ij_*^r. \tag{37}$$

If the set is empty, the project has no feasible interior contract in this model. For the same project and primitives, lowering the rate raises the success residual and the optimized developer payoff, which justifies the rate ranking. It does not specify how banks strategically choose their markups.

Proposition 4. On the same feasible higher-root branch, holding other primitives fixed,

$$\frac{\partial r^*}{\partial c} = \frac{1}{\sqrt{\Delta}} > 0, \frac{\partial r^*}{\partial \zeta} = \frac{p}{\sqrt{\Delta}} > 0. \tag{38}$$

Higher monitoring efficiency lowers the actual rate when $m\theta > 0$, since it lowers c. The proof explicitly incorporates the probability response; holding probability fixed would give different derivatives. Appendix A derives the expressions from the fixed point and pricing identity.

These are local contract comparisons. They do not prove expansion of the complete financing set or an increase in bank market share. Relationship information, location, capacity, historical mortgage clients, and syndicate loan shares are not modeled. The monitoring trade-offs in Carletti (2004) therefore inform the institutional discussion without establishing an optimal syndicate structure here.

5.5 Isolating the effect of endogenous effort

Choose a feasible higher-root initial state θ_0 with $\Delta > 0$, and hold effort at its initial optimum, $\bar{e} = e^*(\theta_0)$. The comparison model retains all other primitives and the bank pricing rule:

$$p^{fix}(\theta) = a + \bar{e} + \gamma\theta, (p^{fix})' = \gamma. \tag{39}$$

At θ_0, effort, probability, loan size, and the contract rate coincide across the two models. Fixed effort need not remain optimal away from that state; this is a channel comparison.

Define, at the selected endogenous-effort contract,

$$\kappa = \frac{\eta LA}{p^2}, u = H' - \frac{(LA)'}{p}, (LA)' = S_0 A + L(m/\mu - s). \tag{40}$$

The quantity u is the change in the success residual when probability is held fixed in the pricing formula. On the higher-root branch, κ equals the ratio of the lower to the higher probability root and lies strictly between zero and one. Differentiating the fixed point gives

$$p' = \frac{\gamma + \eta u}{1 - \kappa}. \tag{41}$$

Relative to the initially matched benchmark,

$$p' - (p^{fix})' = \frac{\eta u + \kappa\gamma}{1 - \kappa}. \tag{42}$$

Proposition 5. At the matched initial state, equilibrium completion probability falls despite $\gamma > 0$ if $\gamma + \eta u < 0$. If the numerator is positive, the factor $1/(1-\kappa) > 1$ amplifies that combined direct response. The response exceeds the fixed effort derivative specifically when $\eta u + \kappa\gamma > 0$.

Proof. Differentiate $p = q + \eta H - \eta LA/p$, collect the p' terms, and use $1 - \kappa > 0$. Subtract γ to obtain (42). Appendix A includes every differentiation step and a feasible numerical example in which the endogenous and fixed effort derivatives have opposite signs.

Amplification of the numerator in (41) and amplification relative to the fixed effort benchmark are different comparisons. Near a repeated root, κ approaches one; the derivative can become large unless the numerator also approaches zero. The ordinary derivative formulas cannot be evaluated at the repeated root itself.

5.6 Numerical illustrations

Two numerical illustrations make the main mechanisms transparent. They use the parameter configurations reported in Appendix A as logical examples only; the values are deliberately uncalibrated, and the figures should not be read as predictions of the August 2026 reforms.

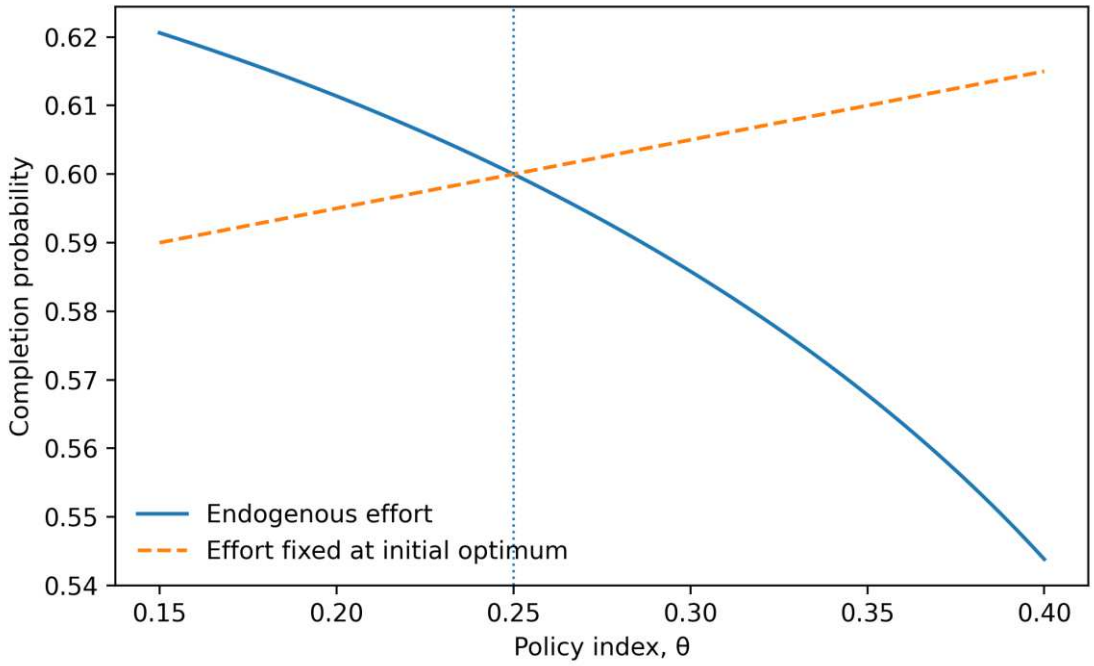


Figure 1 Endogenous effort can reverse the direct completion-probability effect

Figure 1 uses the feasible configuration in Appendix A.12. At the matched point $\theta = 0.25$, the endogenous-effort and fixed-effort models coincide at a completion probability of 0.60. Holding effort at its initial optimum, the direct policy effect raises completion probability as θ increases. With endogenous effort, however, additional borrowing reduces the developer's retained success payoff, effort falls, and equilibrium completion probability declines. Around the matched point the two derivatives therefore have opposite signs, illustrating Proposition 5 rather than adding an empirical calibration.

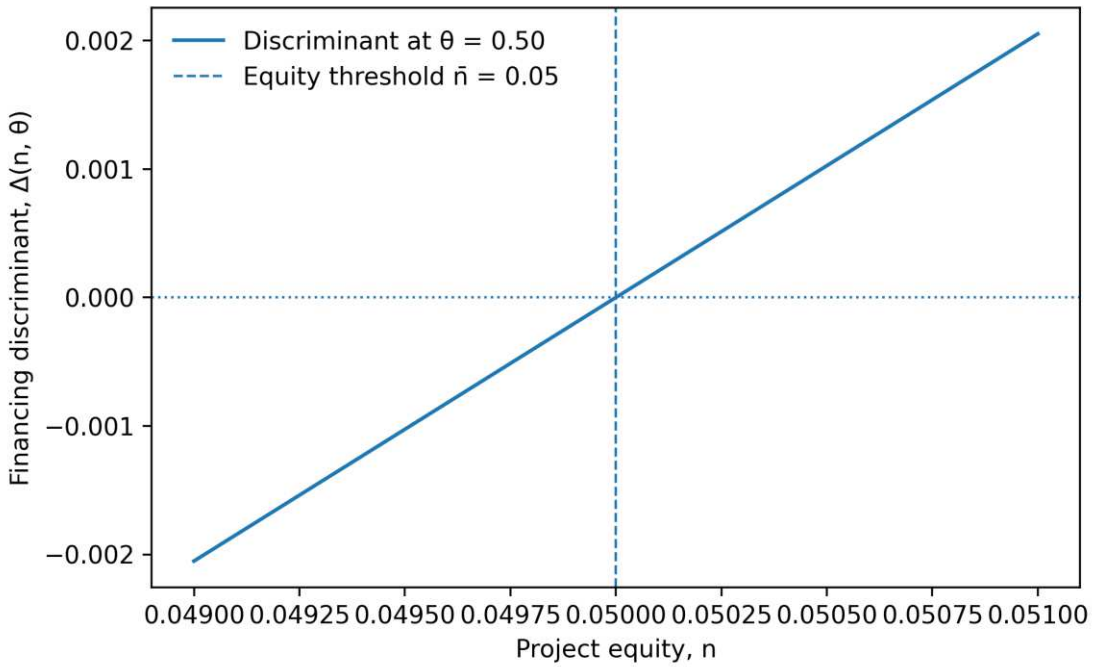


Figure 2 Project equity and the financing-feasibility boundary

Figure 2 uses the parameter configuration in Appendix A.11 at θ = 0.50. The financing discriminant crosses zero at project equity $\bar{n} = 0.05$. Projects just below that value have no real interior pricing–effort fixed point in the specified contract class, whereas projects above it satisfy the algebraic requirement and, under the additional conditions verified in the appendix, enter the feasible set. The figure illustrates why project equity is an access margin rather than merely a balance-sheet control variable.Table 3 reports the loan principal, completion probability, net recovery, and expected unrecovered principal around the matched state.

Table 3 Illustrative exposure and expected principal loss around the matched state

θ	Loan principal L	Completion p	Recovery ρ	Expected loss EL
0.20	0.175	0.611	0.200	0.054
0.25	0.200	0.600	0.200	0.064
0.30	0.225	0.586	0.201	0.075

In the same illustration, the loan principal rises from 0.175 at θ = 0.20 to 0.225 at θ = 0.30 while completion probability falls from 0.611 to 0.586. Expected unrecovered principal therefore rises from 0.054 to 0.075 despite the assumed improvement in recovery. This is the exposure-versus-risk-quality distinction in Proposition 3; different parameter values can reverse the sign.

6 Conditional scenarios and observable implications

The model separates access from the loss on a continuing loan. Table 2 combines these two margins under Proposition 2, a fixed distribution with positive density at the threshold, and the regularity conditions of Proposition 3. The sign of Δ_θ is evaluated at the threshold. A portfolio statement based on the sign of EL' requires that sign to hold for all continuing projects under consideration.

Table 2 Conditional changes in access, lending, and expected loss

Boundary and continuing-loan conditions	Financing access	Aggregate lending	Portfolio expected loss
$\Delta_\theta(\bar{n}) > 0$ and $EL' < 0$	Threshold falls; more projects obtain finance.	Increases.	Ambiguous because entry adds exposure while continuing losses fall.
$\Delta_\theta(\bar{n}) < 0$ and $EL' < 0$	Threshold rises; fewer projects obtain finance.	Ambiguous.	Falls if the loss condition holds throughout the continuing portfolio.
$\Delta_\theta(\bar{n}) > 0$ and $EL' > 0$	Threshold falls; more projects obtain finance.	Increases.	Rises if the loss condition holds throughout the continuing portfolio.
$\Delta_\theta(\bar{n}) < 0$ and $EL' > 0$	Threshold rises; fewer projects obtain finance.	Ambiguous.	Ambiguous because exit removes exposure while continuing losses rise.

Each row follows from the signs of the two terms in (35b) and (36b); the classification is theoretical. Equality cases require separate treatment. In particular, a nearly unchanged discriminant is not evidence that low-equity firms exit. When the assumptions of the threshold result fail, these rows cannot replace direct evaluation of the feasible set.

The model suggests three empirical distinctions. First, data should identify legally usable presale cash and actual project equity, rather than relying solely on contracted sales and group net assets. Second, rates, contractual interest,

and loan principal should be recorded separately for continuing projects; a lower rate can coincide with a greater contractual burden. Third, changes in the number and composition of financed projects should be separated from within-project changes in completion and recovery. Otherwise, improved average loan quality caused by selection can be mistaken for a reduction in every project's risk.

These conditional predictions await a subsequent empirical design; no data are analyzed here. Implementation timing and contract eligibility could help define exposure groups, but causal identification would also have to address local policy selection, changing demand, bank capacity, and the composition of developers. The present analysis does not assume that those identification problems have been solved.

7 Economic implications and scope

7.1 Replacement funding and project eligibility

The first implication is that a restriction on early buyer funding should be evaluated jointly with the replacement funding required before completion. Equation (1) makes the project-level substitution explicit, while Proposition 2 identifies one set of conditions under which deteriorating financing consistency excludes lower-equity projects. For empirical work, the relevant quantities are project cash that is genuinely usable before completion, actual equity committed to the project, and the lender's construction-period funding capacity.

This result does not imply that every excluded project should receive credit. Participation and underwriting constraints are economically meaningful. It instead shows that adequate final sales value is not sufficient for financing feasibility when the project cannot bridge the construction-period funding gap under the available contract.

7.2 Monitoring, pricing, and developer incentives

Better information about construction, payments, sales, and collateral can affect monitoring costs, completion probability, and net recovery. Proposition 1 identifies the pricing comparison: gains in expected receipts must be weighed against additional unit monitoring cost and any markup change. Lower monitoring cost can reduce rates, but sufficiently strong improvements in risk quality can also lower rates even when monitoring becomes more expensive.

Proposition 5 adds an incentive constraint to that comparison. If replacement borrowing sufficiently reduces the developer's retained success payoff, effort can fall enough to offset the direct supervision effect. Account control and monitoring should therefore be evaluated through their joint effects on funding, repayment, and incentives rather than by assuming that tighter control mechanically raises equilibrium completion probability.

7.3 Account control and risk allocation

One lead bank can organize information and account management while other banks participate through a syndicate where permitted. The institutional distinction matters: coordinating monitoring and allocating credit exposure are separate tasks. Proposition 4 supports cost-based comparisons among feasible contracts, but does not identify optimal loan shares, a preferred bank type, or a dominant ownership structure. Those claims would require endogenous monitoring choices, bank constraints, and a model of correlated losses.

The same distinction applies to nonbank finance. Funding eligible development expenditure and refinancing a completed, cash-generating asset are different functions. Instruments should be evaluated against their permitted use of proceeds and asset eligibility. The current model does not derive an equilibrium substitution among loans, corporate bonds, private funds, asset-backed securities, commercial mortgage-backed securities, and real estate investment trusts.

7.4 Financing access and loss measures

A useful monitoring framework would track project financing access, principal per continuing loan, total lending, and expected principal loss separately. Proposition 3 shows why an improvement in one measure cannot stand in for all the others. Removing a high-loss marginal project may lower portfolio expected loss even as the risk of some continuing projects rises. Conversely, extending finance to additional projects can raise total expected loss while improving the quality of every continuing loan.

The scope limitations correspond to specific unanswered questions. Fixed demand and a fixed equity distribution exclude the balance-sheet and general equilibrium responses emphasized by Huang et al. (2025). The static commitment decision excludes the continuation and liquidation of existing unfinished projects. Reduced-form net recovery excludes a detailed legal waterfall and buyer restitution. The absence of bank capacity, loss correlation, and capital absorption prevents conclusions about systemic risk. Empirical estimates and extensions addressing those margins are needed before ranking the reforms' overall benefits and costs.

8 Conclusion

Restricting early presale funding changes more than the timing of housing sales: it changes who finances construction and how the resulting debt claim affects the developer's incentive to complete the project. In the model, early buyer funding is replaced by project equity and development credit, while the bank prices the loan using the completion probability generated by the developer's endogenous effort. This creates a feedback from financing structure to effort and back to loan pricing.

The analysis yields three conclusions. Stronger direct supervision and better recovery do not guarantee a higher equilibrium completion probability, because additional debt service can weaken effort. A financing root is economically relevant only when probability bounds, positive effort, developer participation, and bank underwriting also hold; under sufficient conditions these restrictions generate a project-equity threshold and an extensive margin of credit access. Expected bank loss, finally, reflects risk quality, loan exposure, and selection: a safer continuing project can coexist with a larger principal at risk, while portfolio outcomes also depend on which projects remain financed.

China's August 2026 measures provide a timely institutional motivation for these mechanisms, but the results apply more generally to housing systems in which advance buyer funding is restricted and replaced by monitored project debt. The model does not estimate realized policy effects, welfare consequences, or systemic risk. Those questions require data on usable project cash, actual equity, loan contracts, recovery, bank capacity, and demand. The theoretical contribution is to show why financing access, loan pricing, completion incentives, and bank losses must be evaluated jointly rather than inferred from any single measure of project safety.

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